

UNIVERSITY OF CALIFORNIA
COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION
BERKELEY, CALIFORNIA

California
Reserve

CIRCULAR 178

OCTOBER, 1917

(Reprinted JANUARY, 1919)

(Revised MARCH, 1927)

THE PACKING OF APPLES IN CALIFORNIA

WARREN P. TUFTS¹



Small display of packed apples put up by students of the University Farm School after twelve hours of practice.

INTRODUCTION

Apples well graded and attractively packed will sell at a profit when others of similar quality but poorly displayed may fail to attract the attention of the buyer. With 13,000 acres of young apple trees coming into bearing and with 55,000 acres at present producing in California,² the grower will be confronted by a gradual increase in the state's apple production. The problem of the disposal of this

¹ Assistant Professor of Pomology and Associate Pomologist in the Experiment Station.

² California Crop Report, 1925. State Dept. Agr. Special Publication No. 63. Sacramento, Calif., 1926.

crop is further complicated by the fact that unlike the orange, peach, and prune, the apple is universally grown and must meet competition from all sections of the United States. In order, therefore, to market the California apple successfully, the highest standards of grade and pack must be attained.

According to the United States Census figures for 1910, apples from the Pacific northwest of the previous year sold for 40 cents more per box than did those from California. It is well known that the northwestern states began more than a decade ago to concentrate on a high-class grade and pack for their fruit. The same was true of some of the other states to the eastward while the majority of the California growers allowed themselves to fall behind in this regard. However, it is not too late to improve on these conditions and the recent state legislation is a step in the right direction.³

During past seasons many California apples have been profitably disposed of in European markets and there is no reason to doubt that in the future first-class fruit carefully handled will continue to find a ready sale provided the grade and pack compare favorably with the best from other sections. The best fruit only should be carefully graded and packed. Throwing on the market second-grade produce of any kind tends to lower the price of the fancy grades and for this reason alone fruit growers should refrain from glutting the market with poor stock. Furthermore, the orchardist should dispose of his second and third-grade apples to fruit evaporators and vinegar factories and pack only his first-grade or fancy fruit.

Due to the comparatively short period of consumption of summer apples it is often unprofitable to pack such varieties as the Yellow Transparent, Tetofsky, and Red Astrachan. Also, it is a question if it would be profitable for California growers to pay the cost of packing, transportation and storage on varieties of poor quality, such as the Ben Davis. Varieties of high quality, however, like the Gravenstein, Winesap, Yellow Bellflower, and Yellow Newtown will undoubtedly pay for careful handling.

THE BOX FOR CALIFORNIA APPLES

Various boxes have at one time or another been employed in the packing of apples. Of recent years only two or three have been widely used, but as late as 1904 seven different sizes of apple boxes were to be found on the Seattle market. At the present time Cali-

³ California Standard Apple Act of 1917 (as amended for 1925). A copy of this law may be obtained upon request to the California State Department of Agriculture, Sacramento, California.

California has discarded all others in favor of the so-called "Northwest Standard" apple box (fig. 1, *b*), the dimensions of which are $10\frac{1}{2} \times 11\frac{1}{2} \times 18$ inches, inside measurement, and the "California" or "Watsonville Standard" (fig. 1, *a*), $9\frac{3}{4} \times 11 \times 20\frac{1}{4}$ inches, inside measurement. Hereafter in this discussion, for the sake of brevity, the term "*Standard*" will always have reference to the "Northwest Standard" box, and the term "*California*" will refer to the "California" or "Watsonville Standard" box. With the

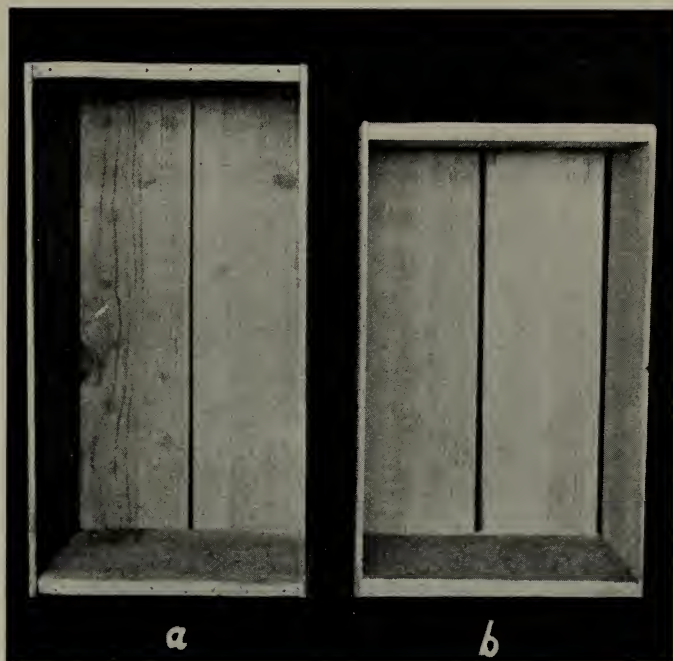


Fig. 1.—*a*, "California" apple box; *b*, "Standard" apple box.

exception of the Watsonville district there is a general adoption of the "Standard" box in California as this is the package which is not only the most widely used throughout the United States, but also the one which is best adapted to the various sizes and shapes of all of our commercial varieties of apple.

Apple boxes come in the "knock-down" form and when ordering box material or "shook," as it is called by the trade, perhaps all the grower need specify is the type of box and its inside measurements. The following should be the dimensions of the "shook" for the "Standard" apple box, but in some localities difficulty may be experienced in securing such material.

STANDARD APPLE BOX

$10\frac{1}{2} \times 11\frac{1}{2} \times 18$ in., inside measurement.

2 pes. ends $\frac{3}{4} \times 10\frac{1}{2} \times 11\frac{1}{2}$ in.

2 “ sides $\frac{3}{8} \times 10\frac{1}{2} \times 19\frac{1}{2}$ in.

4 “ T. & B. $\frac{1}{4} \times 5\frac{1}{4} \times 19\frac{3}{4}$ in.

4 “ cleats $\frac{3}{8} \times \frac{3}{4} \times 11\frac{1}{2}$ in.

Use cement-coated, common 6d nails; 32 nails to box. There are 23,600 6d cement-coated nails in a keg.

THE HANDLING OF APPLES FOR PACKING

Since every step in the handling of fruit from the time it leaves the trees until it is sold has such a vital bearing upon the successful sale of the product, the leading co-operative fruit-growers' organizations now regard the operations of picking, grading, packing, etc., as legitimate parts of the marketing process. After careful consideration of the matter the California Fruit Growers' Exchange has decided that the "production" of the crop ceases when the fruit is ripe on the trees and that the agency that is ultimately to market the product should take charge of it at this point. The organizations were forced to take this position because the growers of citrus fruits failed to appreciate the necessity for handling their fruit with due care, thus vitiating the efforts of the marketing agencies to get satisfactory returns for the product. Apparently this view will shortly prevail among growers of apples, pears, and other deciduous fruits. Too much stress, therefore, cannot be laid upon the importance of proper harvesting methods.

There are two necessary considerations to be borne in mind when harvesting the apple crop; first, the *time* to pick, and second, *how* to pick.

Time to Pick.—The grower may be inclined to delay the picking of his apples beyond the proper stage of maturity in order that they may become larger in size or take on a better color. According to Whitehouse,⁴ there is a quite marked increase in the amount of color during the last few days before picking, and, consequently, under certain association rulings where amount of color is considered, delay in picking various apple varieties may raise the fruit from a lower

⁴ Whitehouse, W. E. A study of variation in apples during the growing season. Oregon Agr. Exp. Sta. Bul. 134:1-13. 1916.



Fig. 2.—Two types of tripod ladders.

to a higher grade. There is also a gradual increase in size, but this merely follows the general growth ratio for the entire season, while in the case of color the rate of increase is much greater during the last week or ten days.

There may be likewise a tendency on the part of some growers to pick too soon in order to take advantage of the high prices often obtainable for certain varieties during the earlier part of the season.

During the past few years considerable work has been done on fruit maturity with the pressure tester. Magness⁵ found that, at the proper picking time the range of pressure for apples varied from 15–19 to 20–25 pounds, depending upon the variety. Investigations conducted by the Experiment Station through one season indicated that 17–21 pounds would be about the best picking range for the Gravenstein variety. It seems very probable that in the near future the pressure tester will be used extensively in determining the proper stage of maturity for harvesting fruit.

If the apples are to be consumed locally, it is perhaps better to allow the fruit to remain upon the trees somewhat longer than otherwise would be advisable in order that they may take on a better size, color, and a somewhat higher quality. The general rule to follow in determining when to harvest is to note the color of the seeds which, in case of most varieties, should be brown. Color of the fruit is taken by some growers as the deciding factor in determining when to pick, while others rely upon the falling of the fruit from the tree, or the ease with which the stem of the apple may be separated from the fruit-spur. In order to pick the fruit at the proper stage of maturity, the grower should learn the traits and characteristics of each variety he is handling; for example, the Gravenstein has a tendency to fall before ripening, the Jonathan at time of ripening. Gravensteins which hang too long are likely to be subject to core-rot, while the White Winter Pearmain may be left on the trees several weeks after most varieties have been picked. Summer apples should be picked somewhat green if intended for shipment, as they have a tendency to drop badly when ripe. It should be borne in mind that yellow and green colors may change for the better in an apple after picking, while the reds change very little, if at all. It costs more to pick over the trees twice, but this cost will generally be more than offset by the increase in color and size of the remaining fruits. In the final

⁵ Magness, J. R., and George F. Taylor. An improved type of pressure tester for the determination of fruit maturity. U. S. Dept. Agr., Department Cir. 350:1–8. 1925.

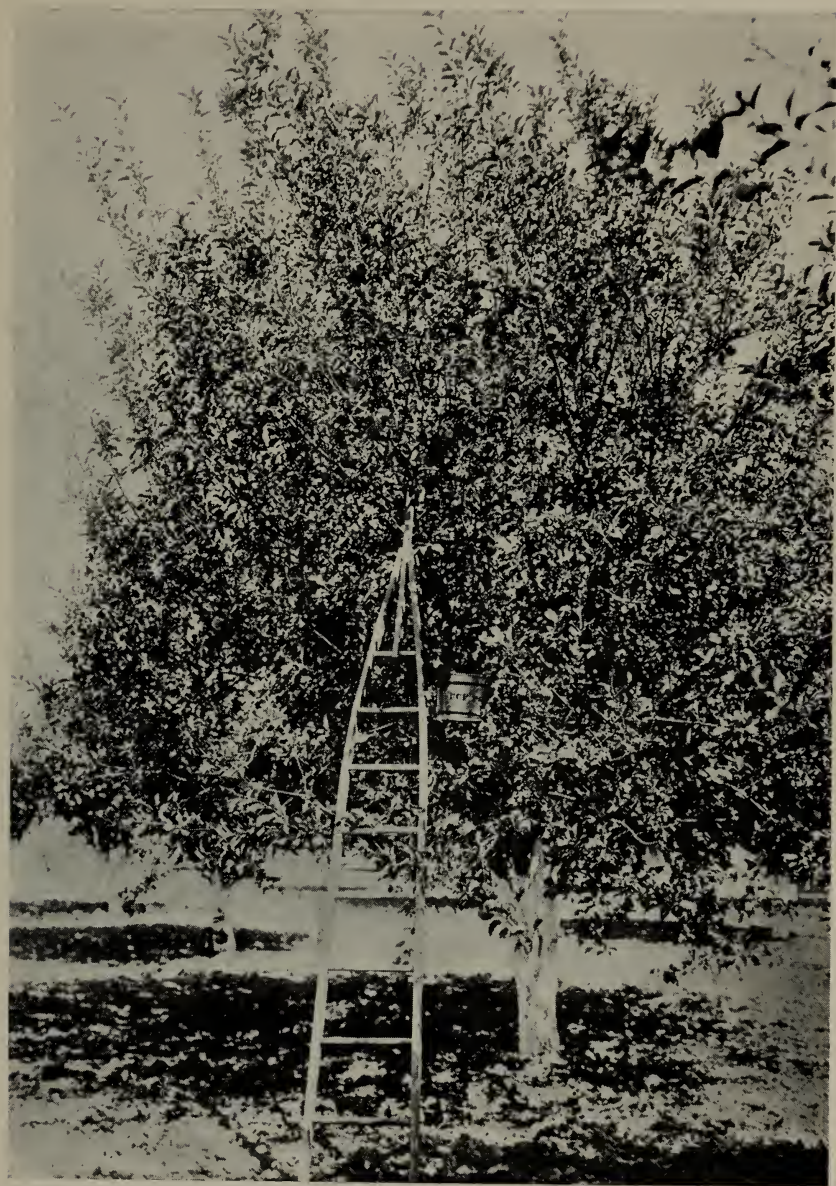


Fig. 3.—Pointed picking ladder.

analysis, however, the grower must decide the proper time of picking for himself, considering the variety, season, soil, shipping distance, and similar factors.

How to Pick.—The apple should be harvested by hand. The soft parts of the hand should be used, care being taken to see that the pickers have finger nails clipped short, and that the individual fruits are not pinched by the fingers in removing them from the fruit-spurs. Here again, a Lawver will withstand more careless handling than will such varieties as the Jonathan, Yellow Bellflower, and Ortley. The foreman of the picking gang will have made much progress toward the desired end, if he can impress upon each worker the idea that the fruit should be handled as carefully as eggs.

The apple is best removed from the fruit-spur by a simple bending or twisting in one direction with the thumb against the stem of the fruit at the junction of the stem and spur. Fruits should never be pulled or jerked straight away from the spur as this is likely to either pull out the stem entirely, or else cause a breaking of the skin at the insertion of the stem in the fruit. Under the present California law all stemless apples, except Gravensteins, go in the lower grades.

When selecting a picking receptacle it is well to remember that if the picker is allowed to use both hands fewer fruit spurs will be broken off, and in addition a much cleaner and quicker job of harvesting done.

The ease with which an apple may be picked depends very largely upon the variety and the stage of maturity. Unless care is taken in harvesting the apples produced on spurs, severe injury may be caused to the spurs themselves and inasmuch as these spurs are the fruiting machinery of the tree, and remain profitable for many years, it behooves the grower to exercise caution in the picking of this crop not to injure his prospects for the years to come. After a spur is once destroyed it is practically impossible to replace it on the old, strong wood which is best able mechanically to bear a heavy load of fruit.

Picking Receptacles.—There are several very satisfactory picking utensils on the market. Some growers prefer baskets of one kind or another, either with or without padding. Some use a plain, large, galvanized iron pail, padded or unpadded. One of the advantages claimed for the pail when used without padding is that the foreman can readily detect pickers doing careless work by the sound of the fruit as it is dropped into the bucket. Baskets and buckets are provided with hooks for hanging in the trees or on the ladders.

Apples should be carefully placed in the receptacle and never thrown or dropped. Probably the two most popular picking receptacles are the picking bag and the patented picking bucket with a bottom so arranged that the fruit may be emptied without bruising. The better types of picking bags are also provided with a patented emptying device for the bottoms, and a ring at the top to hold the mouth open. When selecting a picking bag or sack, one should be *sure* that the



Fig. 4.—Picking bench.

sack will hang, when partially or wholly filled, so that it will be in no danger of coming between the workman and the ladder or main branches of the tree, thus causing severe bruises to the fruit. The picking bag or apron probably enables the fastest picking, but care must always be exercised to see that too much fruit is not placed in such a receptacle at one time, and that in one way or another all chances of bruising are avoided.

Lug-Boxes.—The orchard boxes or lug-boxes into which the fruit is emptied from the picking receptacle should be of fairly heavy material, wide enough to enable the basket, bucket, or bag to be

lowered to the bottom for emptying, and preferably with ends raised above the sides so that when filled with apples and piled one above the other there will be no danger of bruising the top layer of fruit. The ends also should have grooves cut into them to facilitate handling when filled. Lug-boxes should have a capacity of about one packed box of fruit.

Ladders.—A well-constructed tripod or three-legged ladder (fig. 2) is by far the most satisfactory for general use. Such a ladder is more stable than a four-legged ladder under the rough conditions experienced in the average orchard and, furthermore, has the advan-

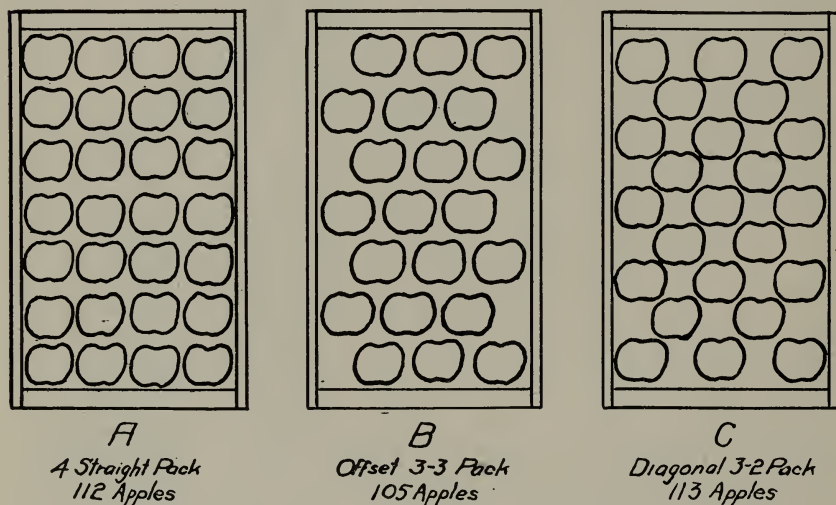


Fig. 5

tage of being so constructed that it may be set up in the midst of an only moderately open-headed tree. There are many types of ladders in common use in the orchards of California, it being possible even to purchase a tripod ladder especially designed for side-hill work and so constructed that the steps are always horizontal, no matter how steep the hill or what the position of the ladder. Apple trees in California have not as yet reached the size attained in the East, where special long ladders have to be laid against the trees in order to reach the fruit, and, under our methods of pruning, probably never will. In the apple orchards of the state it is rarely necessary to place the ladder against the tree, and such practice should be avoided whenever possible on account of the danger of needlessly destroying fruit-spurs. The type of ladder shown in figure 3 is

not placed in such a position that injury to the tree may occur and on account of its lightness and strength can be strongly recommended for apple picking.

One of the best arrangements which the writer has observed is the use of a low bench standing approximately three feet high and broad enough to hold a lug-box (see fig. 4). The picker can place in the box thus held all fruit which he is able to pick from the ground and then, standing on this bench, can pick considerably more. Men with these benches are sent ahead of the main picking crew to remove all the fruit hanging low in the trees, thus saving a great many apples

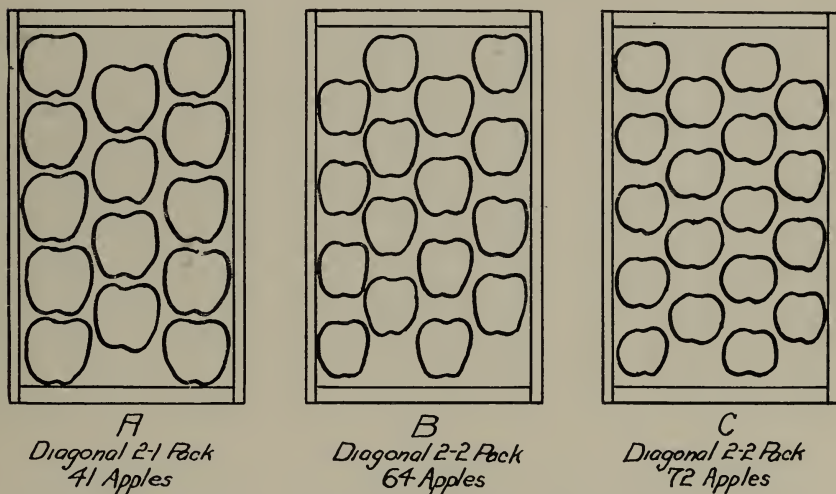


Fig. 6

from being knocked off and lost by teams hauling lug-boxes in and out of that section of the orchard.

Hauling.—The truck used for hauling apples should be low for ease in loading and to enable its use under low-trained trees; it should also be easy riding to prevent any unnecessary bruising of the fruit.

GRADING

Grading is a classification of fruits according to size, color, shape and blemishes. "The Standard Apple Act of 1917" specifies that all apples sold in closed containers shall consist of one of three grades. To grade apples for the market involves two more or less distinct operations, viz., sorting and sizing.

Sorting.—From the very nature of the work sorting for color, shape, and blemishes of any kind must be done by hand, either at the time of picking or, as in the case of apples, in the packing house. The sorter should have explained to him very definitely, the exact limitations of the different grades and his work should be carefully supervised and frequently checked. The packer should likewise be impressed with the idea that no matter how conscientious the sorter may be, it remains with him to make the final selection and upon him in large measure depends the quality of the output. The fruit is brought from the field in lugs and is then sorted into "California

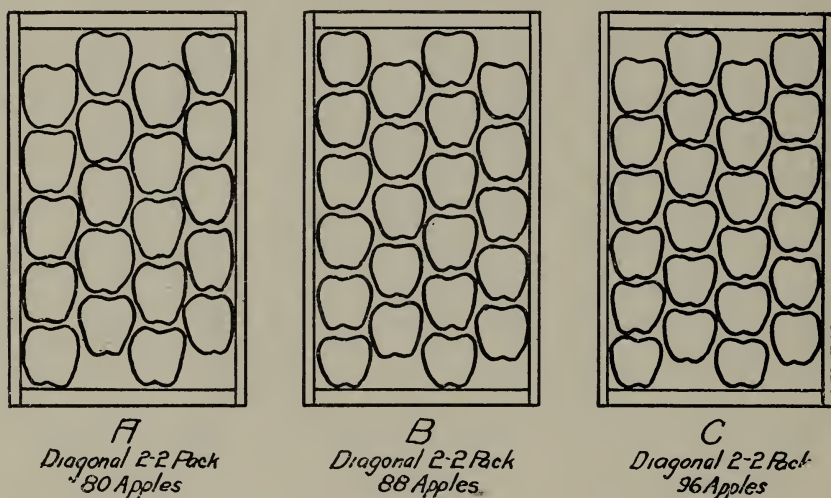


Fig. 7

Fancy," "B," and "C" grades, and culls. At the present time the pack put up by many individuals in the state is really superior to that designated in the law as "California Fancy." And since the trade knows these brands, such packers have little or nothing to gain by labeling their best grade as "California Fancy." This new enactment will, however, go a long way toward raising the general standard of the California product and pack, and the growers in turn will inevitably profit.

Sizing.—After being sorted the apples are sized by machinery before going to the packers' table or sized by hand, either by the packer at the time of packing or separated into the various sizes by other workers before reaching the table. In most instances where the latter scheme is employed the apples are only roughly divided into three groups. In the Pajaro Valley the following divisions are

made: those fruits larger than $2\frac{5}{8}$ inches in diameter; those ranging from $2\frac{5}{8}$ down to $2\frac{1}{4}$ inches; and those smaller than $2\frac{1}{4}$ inches in diameter. With these groups before him it remains with the packer to do the final sizing.

On account of the relative shallowness of the "California" box, it is impracticable to use apples of the same diameter throughout the pack without having the top layer so high that it is almost impossible

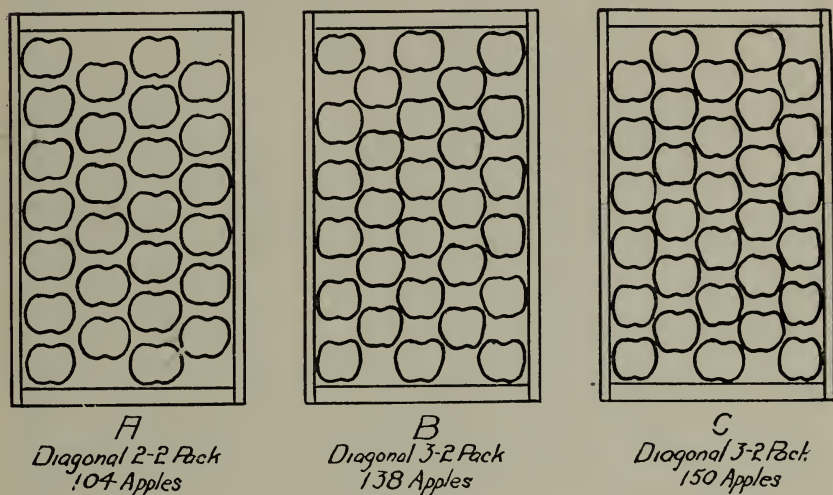


Fig. 8

to put on the cover. The California law allows a variation of three-eighths of an inch in diameter between apples in the same box. In a well-packed "Standard" box, however, the apples should not vary more than one-eighth of an inch in diameter.

STYLES OF PACK

There are three styles of apple packs in use in California; the "square" or "straight" pack (fig. 5, *a*); the "offset" pack (fig. 5, *b*); and the "diagonal" "diamond," or "pear" pack (fig. 5, *c*).

"The "straight" or "square" pack is employed for those apples which by reason of their size and shape can be placed cheek to cheek and just fill the width of the box without forcing and yet closely enough so that a sheet of paper cannot be inserted between fruits nor between fruit and box. The fruits in the second layer rest directly on top of those in the bottom layer and so on until the top

is reached. It is readily seen when the lid is applied under pressure that the only possible way to avoid crushing the fruit is to take care that the pack does not come above the level of the top of the box. As will be pointed out later, a bulge is absolutely necessary if the fruit is to carry well and therefore the packer is left only one other alternative and that is to choose some other style of pack.

The "off-set" pack until the last few years was quite widely used in certain apple-producing sections, but has been generally discarded on account of the relatively large empty spaces left in each layer; otherwise this pack is entirely satisfactory. Inasmuch as this style

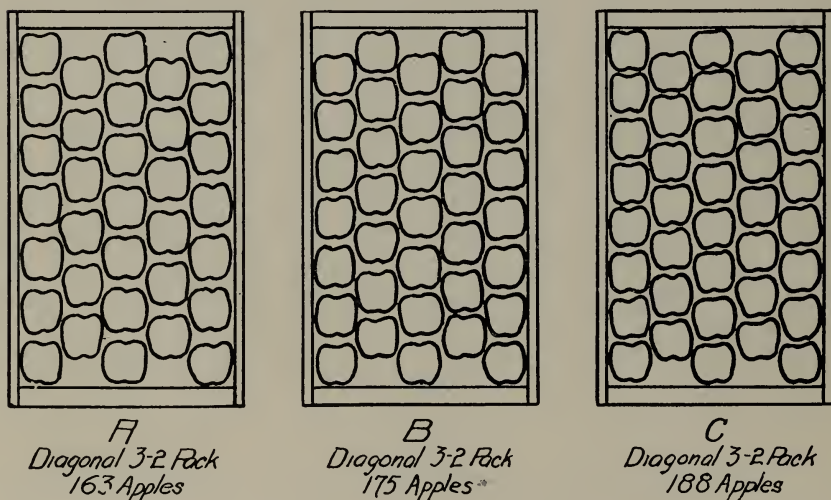


Fig. 9

of pack has been widely experimented with for apples and as widely discarded, there seems to be no good reason for its adoption by California growers.

The "diagonal" pack has proved, after extensive trial, to be the most thoroughly satisfactory in all respects. The apples in the second layer instead of resting on one point of contact with the fruit in the first layer have three points of contact. When the lid is put on and the pressure applied, the fruit, instead of bruising, is simply settled more firmly in the spaces left for this purpose.

The pack in the "California" box is generally designated as a "3-tier," "3½-tier," "4-tier," "4½-tier," or "5-tier" pack. Unfortunately there is considerable confusion in the minds of many



Fig. 10.—Progressive steps in the wrapping of an apple for box packing.

as to exactly what is meant by the term "tier." The sense in which the term is here used means that when apples are of such a size that three of them will just fit, cheek to cheek, across the end of a box, such a size of fruit is called a "3-tier" apple. Likewise, when four apples, cheek to cheek, just fit across the end of the box, we have a "4-tier" size. All apples ranging in size between these two comprise what is technically known as a "3½-tier" size. It is evident, therefore, that a three or four-tier apple will be somewhat different in boxes of varying widths.

In determining the diameter or size of an apple it is invariably measured from cheek to cheek, rather than from stem to blossom-end. In California, apples smaller than 4½-tier are seldom packed. This method of designating the size of the fruit contained in the box is at best clumsy as compared with the exact method employed by giving the actual count of the apples contained. Those growers who still use the term "tier" to designate size give as their reason that in this way they can dispose of their undesirable sizes by including them under the same pack with those most desired. Under this plan there may be as great a variation as fifty apples in a box, but all sell as 4½-tier apples. It is plain then why the street venders, hotel trade, and various other retailing agencies much prefer to buy apples knowing exactly how many fruits will be found in each box. This is of especial importance to those who retail fruits by the dozen. That the trade would eventually give its preference to that fruit which comes to the market in "Standard" containers and plainly marked on the outside as to variety, grade, date of packing, and number in the box was wisely foreseen by those who drafted the "Standard Apple Act of 1917."

The list of apple packs given below is designated for the "Standard" box, the inside dimensions of which are $10\frac{1}{2} \times 11\frac{1}{2} \times 18$ inches. The same table may be employed in calculating the number of apples contained in the "California" box, although on account of the different shape it will be found impossible with certain sizes of some varieties to avoid the "square" pack as can be done with the "Standard" box. These two boxes are very nearly identical as to cubic contents.

APPLE PACKS

Number of fruits in box	Style of pack	Number of fruits in row	Layers deep
225	5 straight	9 long	5
200	5 “	8 “	5
213	3 × 2 diagonal	9 × 8 long	5
200	3 × 2 “	8 × 8 “	5
188	3 × 2 “	8 × 7 “	5
175	3 × 2 “	7 × 7 “	5
163	3 × 2 “	7 × 6 “	5
150	3 × 2 “	6 × 6 “	5
138	3 × 2 “	6 × 5 “	5
125	3 × 2 “	5 × 5 “	5
113	3 × 2 “	5 × 4 “	5
120	2 × 2 “	8 × 7 “	4
112	2 × 2 “	7 × 7 “	4
104	2 × 2 “	7 × 6 “	4
96	2 × 2 “	6 × 6 “	4
88	2 × 2 “	6 × 5 “	4
80	2 × 2 “	5 × 5 “	4
72	2 × 2 “	5 × 4 “	4
64	2 × 2 “	4 × 4 “	4
56	2 × 2 “	4 × 3 “	4
48	2 × 2 “	3 × 3 “	4
50	2 × 1 “	6 × 5 “	3
45	2 × 1 “	5 × 5 “	3
41	2 × 1 “	5 × 4 “	3
36	2 × 1 “	4 × 4 “	3
32	2 × 1 “	4 × 3 “	3

Needless to say the sizes 32 to 56, inclusive, are more for exhibition purposes than for the general market. Packs 72 to 163, inclusive, contain the chief commercial sizes. The bottom layer of representative packs listed in the above table is illustrated in figures 6 to 9.

THE USE OF PAPER IN THE PACKED BOX

Lining Paper.—Paper, known to the trade as “white news,” is used to keep out dust and odors. When starting to pack a box two sheets of this paper are placed in the box in such a way that they overlap on the bottom and are folded over the sides of the box during the process of packing. After the fruit is in place these ends are in turn folded over the finished top of the pack. It is well to give the lining paper an extra crease at the bottom so that when the pack is

finished and the lid applied, the bulge, which is then distributed between the top and bottom, will not tear the lining along the bottom side.

Layer Paper.—A light spongy cardboard or porous blotting paper is placed on the top and bottom of the packed fruit to absorb excess moisture. A sheet of this paper is put in the box as soon as the lining paper is in place, before starting the packing proper, and the second sheet is placed over the finished pack just prior to folding over the ends of the lining paper preparatory to nailing on the top. Layer paper was formerly used in some apple sections between each layer

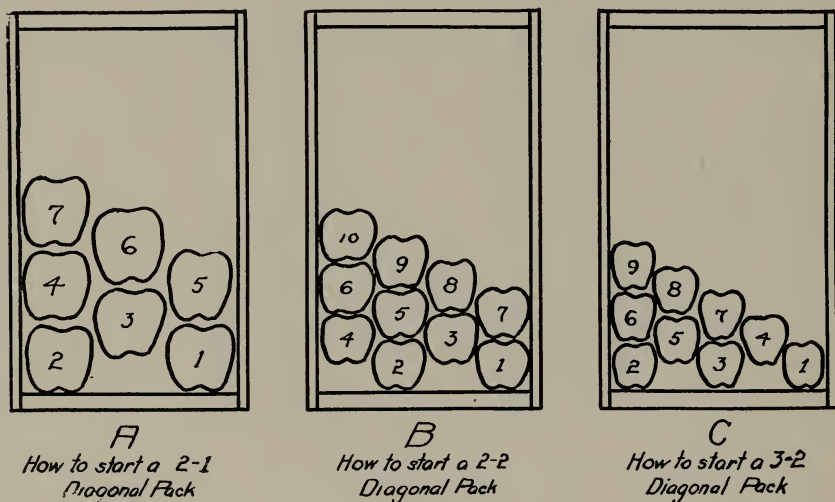


Fig. 11

of fruit or between one or two layers, but this practice has been largely discontinued as it was found in most instances to be an unnecessary precaution. For local shipment it is perhaps not necessary to use layer paper.

Wrapping Paper.—The paper which is placed around each individual fruit is one of the most important features in a successful pack. Dimensions of wrapping paper are given on page 21. The advantages of wrapping each fruit may be enumerated as follows:

1. Checks transpiration, thus reducing loss of weight.
2. Acts as a cushion, preventing bruises encountered both in packing and shipping.
3. Prevents the spread of decay by confining the disease to the one fruit.

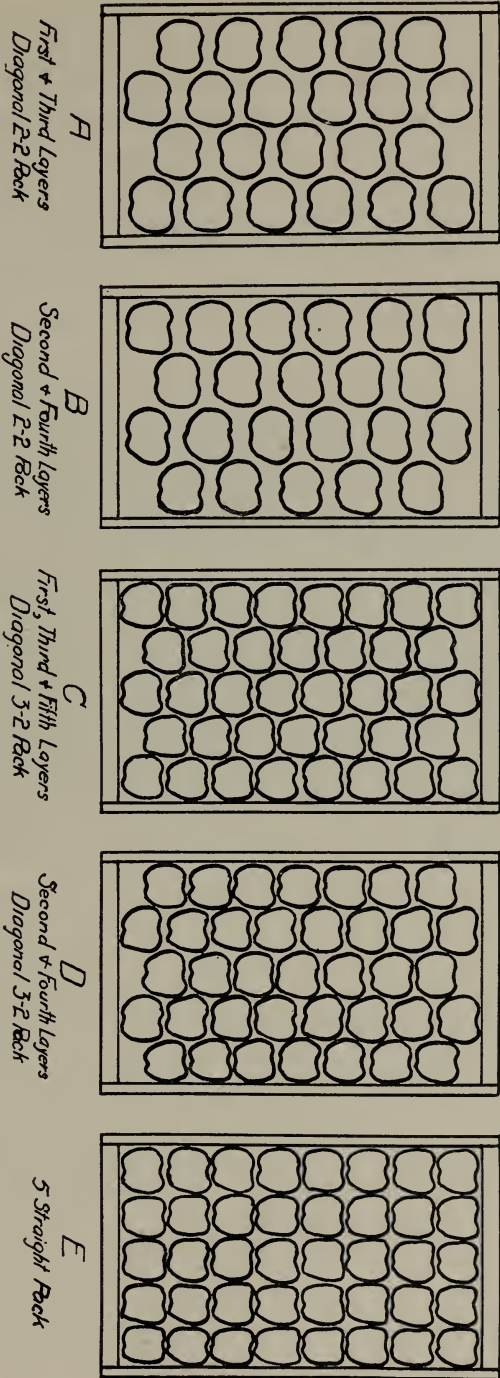


Fig. 12

4. Tends to maintain the fruit at a more even temperature, thus probably prolonging its period of consumption.
5. Gives more finished appearance to the pack, especially if a small, attractive design is printed on each wrapper, which is in addition a good advertisement.

The beginner often raises the question as to the additional time required to pack wrapped apples. Experience has shown that after a few days' practice a man can wrap and pack faster than he can pack without wrapping. The actual time devoted to wrapping is but a fraction of the total time involved and, what is more important, the fruit stays "put," while if packed without wrapping the chances are more than even that when an apple is placed in the box, other apples will be moved from their proper places and thus much time be lost.

Figure 10 shows in some detail one of the methods used in wrapping. There are several very satisfactory "wraps" and every packer as he acquires skill generally devises some system of his own, although nearly all such short-cuts are modifications of one or two distinct "wraps." The method shown by the illustration is perhaps the simplest and when faithfully followed gives maximum speed.

Figure 10, *a*, shows the packer in the act of picking up the wrapping paper with his left hand, having at the same time picked an apple from the packing table with his right hand. Note the rubber fingerstall on the fore-finger of the left hand. By the use of this fingerstall the thin, single sheets of wrapping paper are easily picked up. Some packers use a rubber thumbstall, but the swinging or sweeping motion obtained by this little device when placed on the fore-finger gives the greatest speed. The apple is next tossed, stem up, into the paper held in the left hand, and the right hand, with no lost motion, is brought into the position shown in figure 10, *b*. At no time during the wrapping process does the right hand grasp either the paper or the fruit, its function being merely to offer a rather solid working surface for the left hand. It should be mentioned that the paper is picked up by the thumb and fore-finger toward one corner and the apple, being tossed into the palm of the left hand, leaves more paper below than above the fruit. The next step is accomplished by continuing the upward movement of the right hand and the turning down of the palm of the left hand, as shown in figure 10, *c*. The fourth step in the wrap is the twisting of the fruit with the left hand, the right hand being held firmly in place and at no time grasping the paper or fruit. See figure 10, *d*. Figure 10, *e*, shows the last step,

namely, the left hand placing the wrapped fruit in the box after having placed the fingers over the loose ends of the twist, and the right hand reaching for another apple.

The neatness of the pack, which materially influences the profitable disposal of the fruit, depends largely upon the care given to the wrapping of the individual apples and the placing of each in the box so that the ends of the wrapping paper are tucked out of sight. When properly wrapped and packed these loose ends act as a cushion for the fruit. The use of paper of proper dimensions for the various sizes of apples will also aid in securing neatness.

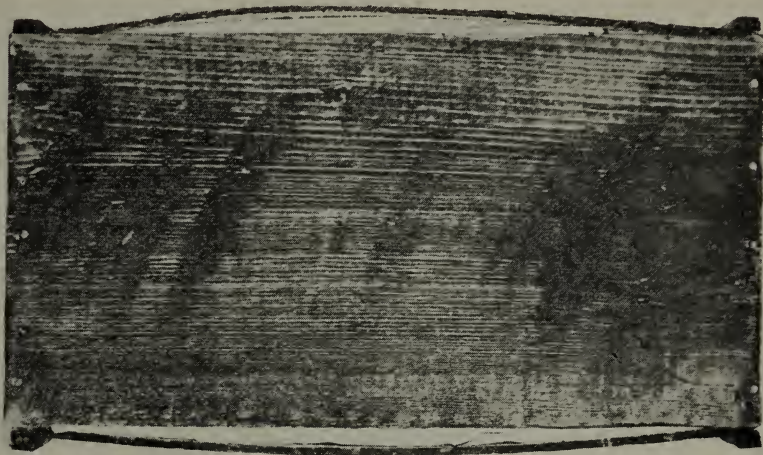


Fig. 13.—Packed box of apples showing proper bulge of both top and bottom.

Rules for Use of Paper:

Use 8 × 8 inch paper for 188 count and smaller.

9 × 9 “ “ “ 175 to 125 count, inclusive.

10 × 10 “ “ “ 112 to 80 count, inclusive.

12 × 12 “ “ “ 72 count and larger.

Wraps for packing 100 boxes of apples 50 lbs.

Lining paper for packing 100 boxes of apples 7½ “

Cardboard for packing 100 boxes of apples 15-16 “

Lining paper, 17¾ × 26 inches for the Standard box, runs 30 sheets to the pound.

Layer paper, 11 × 17½ inches for the Standard box, runs 14 to 15 sheets per pound.

Wrapping paper, 10 × 10 inches, runs 310-325 sheets to the pound. However, there is a variation in this weight due to the varying qualities of paper used.

DETAILED INSTRUCTIONS FOR PACKING A BOX

After having put in place the lining and layer paper the next step is to start the pack, proper.

The 2×1 pack, used very little commercially, takes care of all apples larger than three across the end of the box. This pack should always be three layers deep. Figure 6, *a*, shows the first and third layers of this pack. Place an apple in either corner of the box and then continue as shown in figure 11, *a*, always placing the apple on its cheek, with stem directly away from the packer, keeping the spaces equal in size, watching the alignment, and finally ending so that the apples are held firmly in place by the pack. The second

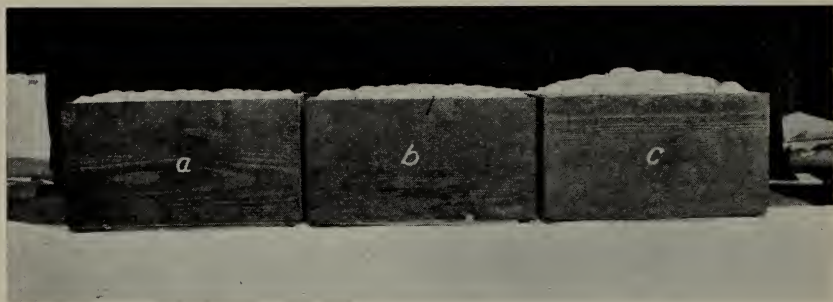


Fig. 14.—Showing, *a*, too little bulge; *b*, proper bulge; *c*, too much bulge.

layer is packed in the spaces left by the first layer and the third layer in turn is packed in the spaces left by the second layer.

The 2×2 pack takes care of all apples larger than four across the end of the box up to and including those just large enough to go three across the end. This pack should always be four layers deep. Figure 12, *a*, shows the first and third layers and figure 12, *b*, shows the second and fourth layers of this pack. Place an apple in the lower left-hand corner of the box and then one between this apple and the right-hand corner so that the spaces between the first apple and the second apple, and between the second apple and the right-hand corner of the box are the same. The next two apples are placed in the spaces thus left and then continue as shown in figure 11, *b*, always placing the apple on its cheek, with stem directly away from the packer, keeping the spaces equal in size, watching the alignment and finally ending so that the apples are held firmly in place by the pack. The second layer is packed in the spaces left by the first layer, the third layer in the spaces of the second layer, and the fourth layer in the spaces of the third layer.

The 3×2 pack takes care of all apples larger than five across the end of the box up to and including those just large enough to go four across the end. This pack should always be five layers deep. Figure 12, *c*, shows the first, third, and fifth layers, and figure 12, *d*, shows the second and fourth layers of this pack. Three apples are first placed in the box, one at either corner and the third in the center. The next two apples are placed in the spaces thus left and then continue as shown in figure 11, *c*, always placing the apple on its cheek, with stem directly away from the packer, keeping the spaces equal in size, watching the alignment and finally ending so that the apples



Fig. 15.—A type of mechanical sizer. Note sorting table at right with canvas drapers for carrying the fruits to the cups by which they are thrown into the various compartments. The lighter the apple the further it is thrown. The fruit is packed directly from these bins.

are held firmly in place by the pack. The second layer is packed in the spaces left by the first layer, the third in spaces of the second layer, the fourth in the spaces of the third layer, and the fifth in the spaces of the fourth layer.

The five-tier straight pack takes care of all those apples that are just large enough to pack five across the end of the box. This pack is always five layers deep. Figure 12, *e*, shows this pack in which all layers are the same. This is the only apple pack to be used when one apple rests squarely on top of another.

In those cases where three or four apples just fit across the end of the box, the diagonal pack should be used. The fact that in the past many apples have been packed in the "California" box by the

“square” or “straight” pack should have no influence in determining the style. A “straight” pack should be avoided whenever possible on account of the great amount of bruising caused by this system. Furthermore, the spaces left between the fruits are too large. It may be urged, in addition, that with the “California” box certain sizes and varieties cannot be packed unless a “straight” pack is employed, but this is all the more reason for definitely adopting the “Standard” box, with which the markets of the world are most



Fig. 16.—Burlap or canvas top packing table.

familiar and in which it is practicable to pack all varieties and sizes by the “diagonal” system.

It should further be stated that with certain sizes of some varieties it is necessary to pack the fruit either stem up or stem down rather than on the cheek, but when this is done care should be exercised to see that the stems are all turned in the same direction. The general rule should be to pack apples on the cheek whenever possible. Never allow the apples to slip sideways as this is likely to cause stem-puncture and in addition spoils the alignment and causes the spaces to be uneven in size. In order to secure the bulge of from $\frac{3}{4}$ of an inch to $1\frac{1}{2}$ inches, counting both top and bottom, which is required on all box-packed apples, care must be exercised to so place the

fruits that the height of the pack is built up faster in the center than at the ends of the box. This extra height of the apples in the center is attained by packing the fruit in the rows at either end so that the *shortest* diameter, as measured from cheek to cheek, comes directly up and down, the fruit being invariably placed on its side. After packing the first two rows next to the end of the box in this way, the apples should be turned so that the *longest* diameter from



Fig. 17.—Table for packing fruit direct from the lug-box.

cheek to cheek will be up and down. As the farther end is reached the apples should again be placed with the short diameter up and down as at the other end of the box. If attention is paid to this detail in packing each layer, little trouble will be experienced in securing the proper bulge and the fruit will not be too high at the ends. For a “diagonal” pack the fruit should not be more than one-quarter or three-eighths of an inch above the ends. The looser the pack, the higher the fruit may be built up and no bruising result when the top is applied. The “square” pack must be held down to a quarter of an inch or less at the ends.

BOX PACKING PROBLEMS

When preparing apples for exhibit the packer is interested in knowing how his pack is to be scored and what points are to be considered by the judges in determining the best commercial box. Undoubtedly the following points would be considered and perhaps an equal value given each, as:

Bulge	20 points
Height at ends	20 “
Alignment	20 “
Firmness	20 “
Evenness	20 “
Total	100 “

Bulge.—As stated above, the total bulge should be at least three-fourths of an inch, but probably not more than an inch and a half, including both top and bottom. Preference is given to a box with a total bulge of about an inch to an inch and a quarter (see fig. 13). This bulge is extremely important in that it makes the package flexible and as the fruit shrinks in storage and shipment the slack is taken up and the pack remains firm. The method of obtaining the bulge has already been discussed. Figure 14 shows a pack having: *a*, too little bulge; *b*, a correct bulge; and *c*, too much bulge.

Height at Ends.—The method of obtaining correct height at the ends has perhaps already been discussed in sufficient detail. The beginner, however, will undoubtedly have considerable difficulty in securing the desired result unless extreme care is exercised. The packer should not be discouraged if the first few boxes have to be repacked three or four times before the fruit comes to the correct height. The proper bulge and height at ends should be striven for throughout all the layers and not left until the top layer is reached. When the pack invariably comes high it may be necessary to use cleats, such as are used in nailing on tops and bottoms to prevent splitting, in order to raise the height of the ends of the box, but this should be done only rarely and cannot be recommended.

Alignment.—If the apples have been correctly sized and well packed, the fruit, as shown by the top layer, will line up vertically, horizontally and diagonally. This well-groomed appearance is an important factor in the profitable disposal of the fruit. Not only is proper alignment a great asset so far as appearance is concerned but, in addition, unless each layer is correctly aligned, it is almost impossible to complete the pack satisfactorily on account of difficulty

encountered in trying to secure fruits of varying sizes to fit the different sized spaces left. Naturally, it is not permissible to start the pack with one size of fruit and then shift to another. If it is found that there are not enough apples of the right diameter on the packing table to finish the box, it may be set aside and another size begun.

Firmness.—Firmness of arrangement in the box is of prime importance in a good commercial pack. The apple should be placed in the box in such a manner that the individual fruits cannot be



Fig. 18.—One type of box-press.

moved by placing the hand upon a layer and exerting a firm pressure in all directions. The packer finds very often, when coming to the end of a layer, that his last row lacks $\frac{1}{8}$ or $\frac{1}{4}$ of an inch of reaching to the end of the box. The beginner is inclined to think this is close enough, but such is not the case. Under such circumstances apples of somewhat longer diameter must be used either throughout the layer or, at least, in the last two or three rows. After making several unsuccessful attempts to use apples of somewhat longer diameter or different shape, it may be found that an incorrect pack is being used and some other style should be adopted for that particular variety and size. To give an idea as to the correct firmness, after packing the first layer, one should be able to turn the box on its side

without any of the fruit falling from place. On the other hand, the fruit must not be jammed or crowded into position, thus causing unnecessary bruising. After a box is packed, it should be possible to put a straight-edge along the side of the box and no bulge be noticeable. This particular point is important inasmuch as the packed boxes are always piled and shipped on the side and should there be any bulge in this direction bruising will take place. Unless firmly packed, apples upon shrinking in storage and shipment will become slack and in spite of the beneficial effects of the "bulge," together with the flexible top and bottom, some fruit will be bruised.

Evenness.—The box should be so packed that when the lid is put down over the fruit every apple in the top layer will be touched. There should be no low or high spots. It is extremely important that there be no bulge from side to side inasmuch as the top consists of two pieces and, being put on under pressure, should one side of the pack be higher than the other, the apples along the center are likely to be cut. The pack should be absolutely flat from side to side. Likewise if the lid does not touch certain of the fruits, these are likely to become loose and be bruised in handling. The greatest difficulty is caused by putting side by side fruits of differing diameters or perhaps more accurately stated (because fruits are supposed to be accurately sized), turning one fruit with long diameter one way and placing the adjacent fruit on the short diameter side. Trouble from unevenness seems to be somewhat greater when fruit is packed with stems up or down than when packed on the cheek. In addition to convenience, an even pack is also very desirable from a commercial standpoint. It has often been pointed out that the consumer purchases with his eyes; a good even pack makes a strong appeal to the prospective buyer.

HANDLING FRUIT IN THE PACKING HOUSE

The packing house should be arranged in such a way that the fruit will pass, with the least amount of lost motion, through the various operations of unloading from the orchard wagon into temporary storage, sorting, sizing, packing, nailing, marking, labeling, and finally moving either directly into cold storage in connection with the packing house or hauling to a central storage plant to await sale or shipment. The individual grower must give considerable study to his particular needs and arrange his house accordingly. By a systematic arrangement of their packing houses some growers have been able to reduce the expense of handling from 2 to 8 cents per

box below their former costs. Only a few brief general statements can here be made.

The cheapest form of packing house and one that is considerably used, especially in the newer sections where but few crops have as yet been harvested, consists of a large tent. The use of a mechanical sizer makes the use of such a house make-shift feasible on account of the greater speed of the packers and consequently the less room needed for temporary storage. A good packer will put up 125 to



Fig. 19.--Another type of box-press.

200 packed boxes a day when the fruit is sized for him, as against 50 to 75 boxes when he sizes the fruit himself. More permanent packing houses to accommodate an orchard of, say 40 acres, will cost from \$2000 to \$8000, according to the type of construction. Of course, cheap sheds can be constructed for less than this, but such a building has little advantage over a tent. A packing house should offer some protection to the fruit in the way of cool storage at least and to obtain this requires a good type of construction. Probably the community packing house and cold storage plant will prove to be the most satisfactory solution for the growers in many sections.

The most economical movement of fruit through the packing house is by gravity. Wherever possible, fruit should be handled by means

of gravity carriers, of which there are several satisfactory kinds on the market. As an instance of the saving effected by these carriers, the case of one packing house in Watsonville may be cited. After installing a gravity roller carrier about fifty feet in length, the output with the same number of packers was increased 200 boxes a day and the labor of four roustabouts discontinued. With proper planning of the packing house, gravity carriers may profitably be installed in such places as from the unloading platform to temporary storage, from the storage room to the sorting table, from packing tables to nailing and marking bench, and from nailing bench to storage room.

The fruit as it comes from the temporary storage goes directly to the sorting table where it is graded, according to color, shape, and blemishes, into "California Fancy," "B," or "C" grades, and culls. Sorting is done at this stage whether the fruit is later sized by machine or hand. If sized by machine, two grades are generally accommodated at one time so that the sorted apples are placed directly on the sizing machine, the remaining grades being placed in boxes conveniently located to be run through the sizer on the second run. Packing tables holding one size only are a composite part of the modern sizing machine (fig. 15). These sizing machines formerly measured the diameter of the apple, but the present tendency is toward a machine which sizes the fruit according to weight.

Two types of packing tables are in common use where the sizing is done by the packer. Figure 16 shows a canvas or burlap-top table, four feet square and capable of holding about three boxes of apples. This table should be substantially constructed. Care should be taken to bevel the tops of the legs so no bruising of the fruit will take place. An extra piece of burlap fastened along one side is convenient for quickly cleaning the table of debris. The other type of table with top at an angle of 45 degrees, shown in figure 17, is designed to enable the packer to take the fruit directly from the lug-box as it comes from the sorter, thereby preventing any bruising which may be occasioned by rolling the apples on the canvas-top table mentioned above. As shown in the illustration this system contemplates the packing of three or four sizes at one time. The canvas-top table will probably give the most satisfactory service. In both of these illustrations attention is called to the "paper-hod" for holding the wrapping paper convenient for use. A spring needle is placed on the side of the "paper-hod" to hold the paper in place. Either form of packing table as well as the "paper-hod" can easily and cheaply be made by the grower.

Another very important piece of the packing house equipment and one which can also be made by the grower is the "nailing" or "box-press." Figures 18 and 19 show two types of press. In both presses the opening in the top of the table for the packed box should be large enough to accommodate the size of box which is being used, being somewhat longer for the "California" than for the "Standard" box. Likewise the iron "goose-neck" in the press, features in figure 19, will have to be varied according to the box used. This goose-neck is the most important feature of this press, enabling the tops to be quickly and conveniently put in place. The latter press is recom-



Fig. 20.—A properly packed box of apples presents a similar face on top, bottom, and sides.

mended as being simpler in operation and therefore cheaper to use. Tops, cleats, and nail stripper should be conveniently located to the nailing-press.

As the top is nailed on it is generally the duty of the nailer to properly mark either by machine or stencil the following information concerning the box: Variety, date packed, grade, number of apples in the box, net weight, and the name and address of the person or firm doing the packing. On the other end of the box an advertising lithograph is generally pasted. This is a very useful means of identification and a valuable advertisement if the grower keeps up the quality of his pack. This lithograph should not be in gaudy colors, but rather in tints and may or may not deal with fruit or fruit-growing scenes.

